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BEHAVIOR AND MUCUS SECRETION OF JAPANESE MARSH CLAM, *CORBICULA JAPONICA* PRIME[1,2]

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(With 4 figures)

Corbicula japonica Prime is commonly found in brackish water area, ranging from Saghalien to Kyushu, and one of the edible clams in Japan.

In Teizan Canal, one of the brackish water areas near Sendai, connecting Matsushima Bay and Natori River, a simple constituted bottom community was found, whose dominant animals were *Corbicula japonica* and Japanese palolo, *Tyrrorhynchus heterochaetus*. In the ecological survey some interesting problems were proposed:

The young clam (less than about 18mm in shell length) populated the restricted stations, i.e., ranging from the mouth of a small stream flowing into the canal up the stream to about a km, and further growing clam after one year old seems to spread gradually her habitat getting the tidal currents. The same phenomenon was ascertained in brackish lakes, Hachiro-gata, Akita Prefecture, and also in Hinuma, Ibaragi Prefecture.

And the population density of the young is higher in the said habitat than that of the adult clam, furthermore the young seemed to aggregate each other here and there in about median of the stream (Fig. 1). Such young clam does not yet develop the gonads and her shell is covered with olive-colored periostracum.

These young specimens caught in such habitat were reared in the sea water with various concentrations, and then freezing point depression of their body fluid was measured by means of the Beckman's thermometer. The results obtained showed a sharp contrast to them of the adult ones, the values of Δ in the young correspond to the concentrations of the reared media (Fig. 2). Taking such a fact it may be accepted that these young ones fail in an osmoregulatory function differing from the adult ones. On the other hand, it was ascertained under the field conditions that the young ones maintained a characteristic osmotic concentration of their body fluid with all concentrations of environmental waters in nature.

1) This contribution is dedicated to Professor T. Jimbo in honor of his biological study.
2) Contributions from the Marine Biological Station of Asamushi, Aomori Ken, No. 252.

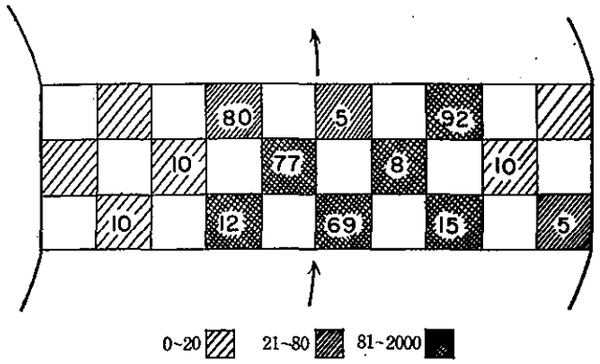

Fig. 1. Schematic representation showing the distribution of the young clam in one station crossing the both sides of the canal. The numerals in the quadrate show percentages of the young to the total number of the clam. The numerals at the bottom of the figure indicate individual number per quadrate of 1 × 1 m. Arrows show the direction of streaming.

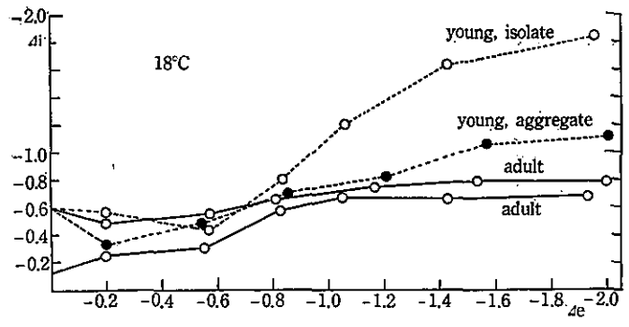

Fig. 2. Showing the relation between the values of body fluid (Δi) and environmental medium (Δe) 4 hours after immersing in the respective medium.

The osmoregulation found in the adult ones was connected with the calcium metabolism and the endogenous enzyme system, and may occur in the membrane of the body. That is, the osmotic concentrations of body fluid of the adult clam ran parallel with that of the medium with variously concentrated sea waters without calcium. On the contrary, the osmoregulatory phenomenon in the young ones was not based on the medium with or without calcium but on the individual density in the glass vessel, the characteristic osmotic concentration is sustained by such a high density as the individuals touch each other, but in such a case their osmotic concentration approaches to that of the medium after a long period of time.

Body weight of the young increased about one per cent in the hypertonic sea water in 3 hours and afterwards decreased slowly (Fig. 3). Such fact may be

contrast to our general conception. The characteristic phenomenon was observed only when the individual density was very high. And it was found that the viscous substance was secreted by the young individual reared in high density in the small aquarium. And the viscous substance was discriminated to be one of the mucin by the qualitative chemical testings.

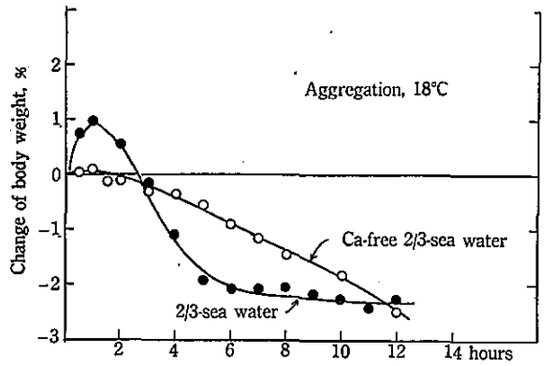

Fig. 3. Changes of body weight in hypertonic sea water compared with that in calcium-free sea water.

From above-mentioned facts it may be comprehended that the secretion of mucus is accelerated by such a high density and the mucus attaching to the body surface of the young may play a role to check temporarily a perfusion of water from or into the body through its surface, and also in the hypertonic sea water the mucus attaches to the surface of the body in the beginning and resulted to increase the body weight during the first period.

Being difficult to analyse the said mucin quantitatively, for the present, for this purpose consumption of potassium permanganate was measured instead of mucus directly. By means of such a simple method it was obtained that the value increased suddenly after 3 to 4 hours under the aggregated conditions, and afterwards its value was always higher in the aggregation than that in the isolation (Fig. 4).

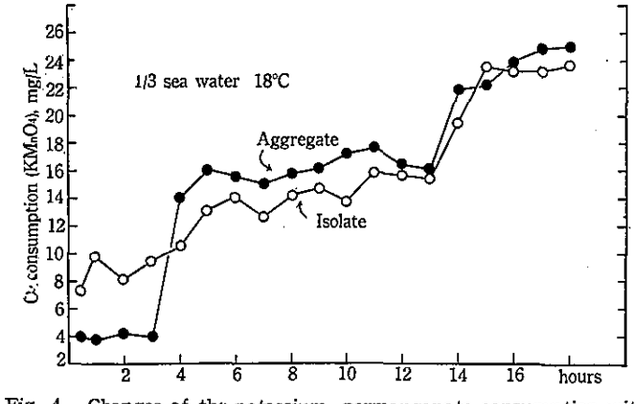

Fig. 4. Changes of the potassium permanganate consumption with the lapse of time, especially compared aggregation with isolation.

On reflection, whether the metabolic rate of individuals is higher or lower in the aggregation than that of isolated ones? The metabolism of the former being higher than the latter, it can not be accepted that the volume of potassium permanganate consumption changes in parallel with that of the secreted mucous substances, in other words, a high value of it shows not always a high concentration.

Replying to the question, the respiration, i.e., the consumption of dissolved oxygen in medium was measured by Winkler method in usual closed vessel. The results obtained showed that the respiration of each individual was lower in aggregation than in isolation. But in such a closed vessel, it may be considered that carbon dioxide secreted in respiration was accumulated in the vessel and resulted to acidify the respiration medium, in fact, the medium showed a fall to about 6.0 in hydrogen ion concentration during the experiment.

In this case it may be comprehended the fall of hydrogen ion concentration check to some extent the respiration rate as in the aggregation. To this question, respiration chamber of open system was designed and the respiration medium was running slowly and regularly from a large bottle. Using such apparatus the oxygen consumption was measured under aggregation and the results were the same as in the closed vessel, that is to say, the respiratory rate was lower in the aggregation, in spite of holding the initial value in hydrogen ion concetration.

When carbon dioxide-saturated isotonic sea water was poured on the isolated young clams in the respiratory chamber with a small pipette, her respiratory rate fell down as in above-mentioned aggregation. The simple experiment seems to show that the same effect was presented by the carbon dioxide-saturated sea water as the aggregation, and the mucus secretion was accelerated by the same artificial treatment.

The young clam was activated to secrete mucus by hypotonic and hypertonic sea waters, i.e., mucus secretion was minimum in isotonic medium which was about 0.25 times of normal sea water. Mucus secretion was accelerated in maximum by the weakly acidified medium, i.e., 5.0 to 6.0 in pH. And also they were activated to secrete maximally the mucus in 27 to 28°C in water temperature. No sharp effection was found by ammonium concentrations in the medium.

Morphological basis of mucus secretion was studied histochemically in next, mucus gland was observed even in all parts of the body surface, but especially the multicellular mucus glands were distributed in the mantle and the gill. Of these organs, the mucus glands in the gill were conspicuous, these glands were situated in the base of some gill filaments, that is, among interfilamentar junctions. These mucus gland seems to be characteristic to the subgenus *Corbicula* s. s.